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Bristol-Myers Squibb Manufacturing Company

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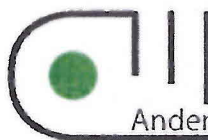
2015 APR -8 AM 11: 32

***Building 5 Area Source Removal
Phase 5 Implementation Report***

***Bristol-Myers Squibb Manufacturing Company
Humacao, Puerto Rico***

April 2015

PREPARED BY ANDERSON MULHOLLAND & ASSOCIATES, INC.



Anderson Mulholland & Associates
ENVIRONMENTAL CONSULTANTS

Table 1
Depth and Volume of Clean and Impacted Soil in Each Cell
Bristol-Myers Squibb Manufacturing Company
Humacao, Puerto Rico

Cell Number	Anticipated Excavation Depth (ft bgs)	Depth of Clean Soil (ft bgs)	Volume of Clean Soil (cu yds)	Depth of Impacted Soil (ft bgs)	Depth of Bottom Sample (ft bgs)	Volume of Impacted Soil (cu yds)
E-1S	7.0	3.0	12	10.0	15.0	26
E-1N	7.0	3.0	12	15.0		45
E-2	14.0	4.0	30	12.0	NC	60
E-3	12.5	5.0	38	11.5	11.5	49
E-4	9.5	0.0	0	10.0	10.0	75
E-7S	12.5	8.0	83	13.0	13.0	52
E-7N	12.5	7.0	73	13.0		63
E-8S	13.5	8.0	83	12.0	12.0	42
E-8N	13.5	6.0	63	12.0		63
E-12S	12.0	2.0	21	12.5	13.0	109
E-12N	12.0	4.0	42	13.0		94
E-16S	11.0	0.0	0	13.5	13.0	140
E-16N	11.0	5.0	52	11.5		68
E-17S	11.0	9.5	99	12.0	12.0	26
E-17N	11.0	5.0	52	11.5		68
D-26W	12.5	10.0	104	13.0	13.5	32
D-26E	12.5	7.0	73	13.0		63
D-29	11.0	4.0	83	13.0	12.0	187
D-31S	10.0	8.0	83	11.0	10.0	32
D-31N	10.0	2.0	21	10.0		83
D-32S	13.5	8.0	83	13.0	14.0	52
D-32N	13.5	4.0	42	14.0		104
D-34	8.5	3.5	73	13.0	13.0	198
D-36W	10.5	10.0	104	13.0	11.5	32
D-36E	10.5	7.0	73	11.5		47
Total Cubic Yards			1399			1810

Table 2
Analytical Results - Excavation Base Samples
Bristol-Myers Squibb Manufacturing Company
Humacao, Puerto Rico

Sample ID			AREAEC11_BOT (13.5')	AREAD-15 BOT (12')	AREAEC_12BOT (10')	AREAEC_13BOT (14')	AREAD-14BOT (13')	AREAEC8_BOT (11.5')
Sample Depth								
Sample Date			2/23/2013	3/2/2013	2/28/2013	2/28/2013	3/1/2013	2/20/2013
Cell ID	Tier 1 Level ¹	Tier 2 Level ²	D-26	D-29	D-31	D-32	D-34	D-36
Units in mg/kg								
Acetone	1600	58	0.161 J	0.0661 J	0.189	0.0606	0.0429 J	0.0718
Benzene	100	0.052	0.068 U	0.00078 J	0.0016	0.0017	0.0008 J	0.0011 J
Ethylbenzene	100	15.6	0.683	0.0033	0.001 J	0.0135	0.012	0.00059 J
Toluene	100	13.8	0.068 U	0.0012 U	0.0013 U	0.0013 U	0.0012 U	0.0019 U
Xylene (total)	300	196	1.71	0.0118	0.0038	0.0543	0.046	0.0345
MIBK	330	5.6	0.224 J	0.0429	0.0063 U	0.0066 U	0.0928	0.0094 U
Isopropyl Alcohol	NA	162	0.11 UR ^a	0.12 UJ	0.11 UJ	0.13 UJ	0.13 UJ	0.17 UR ^a
Methanol	7.5 mg/l (TCLP)/150 mg/kg	162	19.7 J	0.23 UJ	0.22 UJ	1.02 J	1.67 J	62.6 J

Sample ID			AREAEC6_BOT (15')	AREAEC3_BOT (11.5')	AREAEC2_BOT (10')	AREAEC10_BOT (13')	AREAEC4_BOT (12')	AREAEC_9BOT (13')	AREAEC7_BOT (13')	AREAEC1_BOT (12')
Sample Depth										
Sample Date			2/25/2013	2/7/2013	2/7/2013	2/23/2013	2/8/2013	2/27/2013	2/19/2013	2/6/2013
Cell ID	Tier 1 Level ¹	Tier 2 Level ²	E-1	E-3	E-4	E-7	E-8	E-12	E-16	E-17
Units in mg/kg										
Acetone	1600	58	0.0712	0.143	16	0.0481	0.151	0.011 UR ^b	0.86 U	0.036
Benzene	100	0.052	0.0019	0.0034	0.081 U	0.0018	0.0023	0.0028	0.086 U	0.00085 J
Ethylbenzene	100	15.6	0.0024	0.00089 J	0.782	0.0026	0.00046 J	0.033	1.2	0.0023
Toluene	100	13.8	0.0005 J	0.003	0.793	0.00027 J	0.00037 J	0.00034 J	0.086 U	0.0014 U
Xylene (total)	300	196	0.0104	0.0348	3.19	0.0112	0.0045	0.115	4.5	0.0143
MIBK	330	5.6	0.0157	0.006 J	7.39	0.0054 J	0.0418	0.0057 U	0.43 U	0.0016 J
Isopropyl Alcohol	NA	162	0.11 UR ^a	0.13 U	31.7	0.11 UR ^a	0.12 U	0.12 UJ	0.14 UR ^a	0.13 U
Methanol	7.5 mg/l (TCLP)/150 mg/kg	162	18.7 J	47.2	26.8	14.1 J	0.23 U	0.56 J	32.1 J	13.8

Notes:

U Indicates that the compound was analyzed for, but not detected. The sample quantitation limit, corrected for dilution and percent moisture, is reported.

J Indicates an estimated value. The value reported is less than the reporting limit but greater than the method detection limit.

R Indicates that the data was rejected during validation. The reason for data rejection is footnoted and described below:

^a Sample analyzed after holding time.

^b Continuing calibration % difference outside control limits for acetone

¹Tier 1 Levels represent alternative land disposal restriction treatment standards for contaminated media (i.e., ten times the universal treatment standard) in accordance with 40 CFR §268.49(c)(1)(C).

²Tier 2 Levels represent migration to groundwater screening levels from USEPA Regional Screening Levels (January 2015). Values shown are based on a dilution attenuation factor of 20.

Table 3
Analytical Results - Excavation Side-Wall Samples
Bristol-Myers Squibb Manufacturing Company
Humacao, Puerto Rico

Sample ID			AREAEC1_SW	AREAEC3_SW
Sample Depth			(8')	(3')
Sample Date			2/6/2013	2/7/2013
Cell ID	Tier 1 Level ¹	Tier 2 Level ²	E-17	E-3
Units in mg/kg				
Acetone	1600	58	0.68 U	NA
Benzene	100	0.052	0.068 U	NA
Ethylbenzene	100	15.6	0.471	NA
Toluene	100	13.8	0.068 U	NA
Xylene (total)	300	196	1.71	NA
MIBK	330	5.6	0.34 U	NA
Isopropyl Alcohol	NA	162	0.12 U	255
Methanol	7.5 mg/l (TCLP)	162	50.5	29.1

Notes:

U Indicates that the compound was analyzed for, but not detected. The sample quantitation limit, corrected for dilution and percent moisture, is reported.

J Indicates an estimated value. The value reported is less than the reporting limit but greater than the method detection limit.

NA - Not Analyzed

¹Tier 1 Levels represent alternative land disposal restriction treatment standards for contaminated media (i.e., ten times the universal treatment standard) in accordance with 40 CFR §268.49(c)(1)(C).

²Tier 2 Levels represent migration to groundwater screening levels from USEPA Regional Screening Levels (January, 2015). Values shown are based on a dilution attenuation factor of 20.

Table 4
Analytical Results - Biopile Performance Samples
Bristol-Myers Squibb Manufacturing Company
Humacao, Puerto Rico

Sample ID			A1-9	A2-2	A-2-6	A-2-9	A-2-9 (Dup)	A3-8	A3-8 (Dup)	A-3-3	A4-5
Cell ID			A1	A2	A2	A2	A2	A3	A3	A3	A4
Sample Depth			(2-2.5')	(6.5-7')	(6.5-7')	(5.7-6.2)	(5.7-6.2)	(2-2.5')	(2-2.5')	(2-2.5)	(6.5-7')
Sample Date	Tier 1 Level ¹	Tier 2 Level ²	6/5/2013	6/5/2013	9/13/2013	11/20/2013	11/20/2013	6/5/2013	6/5/2013	9/13/2013	6/5/2013
Units in mg/kg											
Acetone	1600	58	4.16	33.9 J	NA	NA	NA	14.6 JJ	17.5 J	NA	0.68 U
Benzene	100	0.052	0.054 U	0.056 U	NA	NA	NA	0.058 U	0.057 U	NA	0.068 U
Ethylbenzene	100	15.6	0.798	165	83.8	NA	NA	93.4	129	20.1	1.72
Toluene	100	13.8	0.054 U	0.501	NA	NA	NA	4.31	5	NA	2.56
Xylene (total)	300	196	3.96	632	331	632	1080	382	483 J	140	5.52
MIBK	330	5.6	8.37	140	NA	NA	NA	62.9	72.1	NA	4.63
Methanol	7.5 mg/l (TCLP)	162	3.25	3	NA	NA	NA	51	48.5	NA	0.25 U

Sample ID			B1-3	B2-7	B3-8	B-3-6	B-3-6 (Dup)	B4-6
Cell ID			B1	B2	B3-8	B3	B3	B4-6
Sample Depth			(6.5-7')	(2-2.5')	(6.5-7')	(6.5-7)	(6.5-7)	(2-2.5')
Sample Date	Tier 1 Level ¹	Tier 2 Level ²	6/5/2013	6/5/2013	6/5/2013	9/13/2013	9/13/2013	6/5/2013
Units in mg/kg								
Acetone	1600	58	20.7 J	0.012 U	30.9 JJ	NA	NA	5.56
Benzene	100	0.052	0.052 U	0.0012 U	0.0314 J	NA	NA	0.073 U
Ethylbenzene	100	15.6	28.6	0.0012 U	1070	41 J	10 J	1.1
Toluene	100	13.8	0.268	0.0012 U	112	21.2 J	4.81 J	0.073 U
Xylene (total)	300	196	115	0.0012 U	4350	159 J	40.6 J	5.71
MIBK	330	5.6	72.4	0.006 U	347	41.9	67.8	13.4
Methanol	7.5 mg/l (TCLP)	162	2.97	0.23 U	0.26 U	NA	NA	9.15

Notes:

U Indicates that the compound was analyzed for, but not detected. The sample quantitation limit, corrected for dilution and percent moisture, is reported.

J Indicates an estimated value. The value reported is less than the reporting limit but greater than the method detection limit.

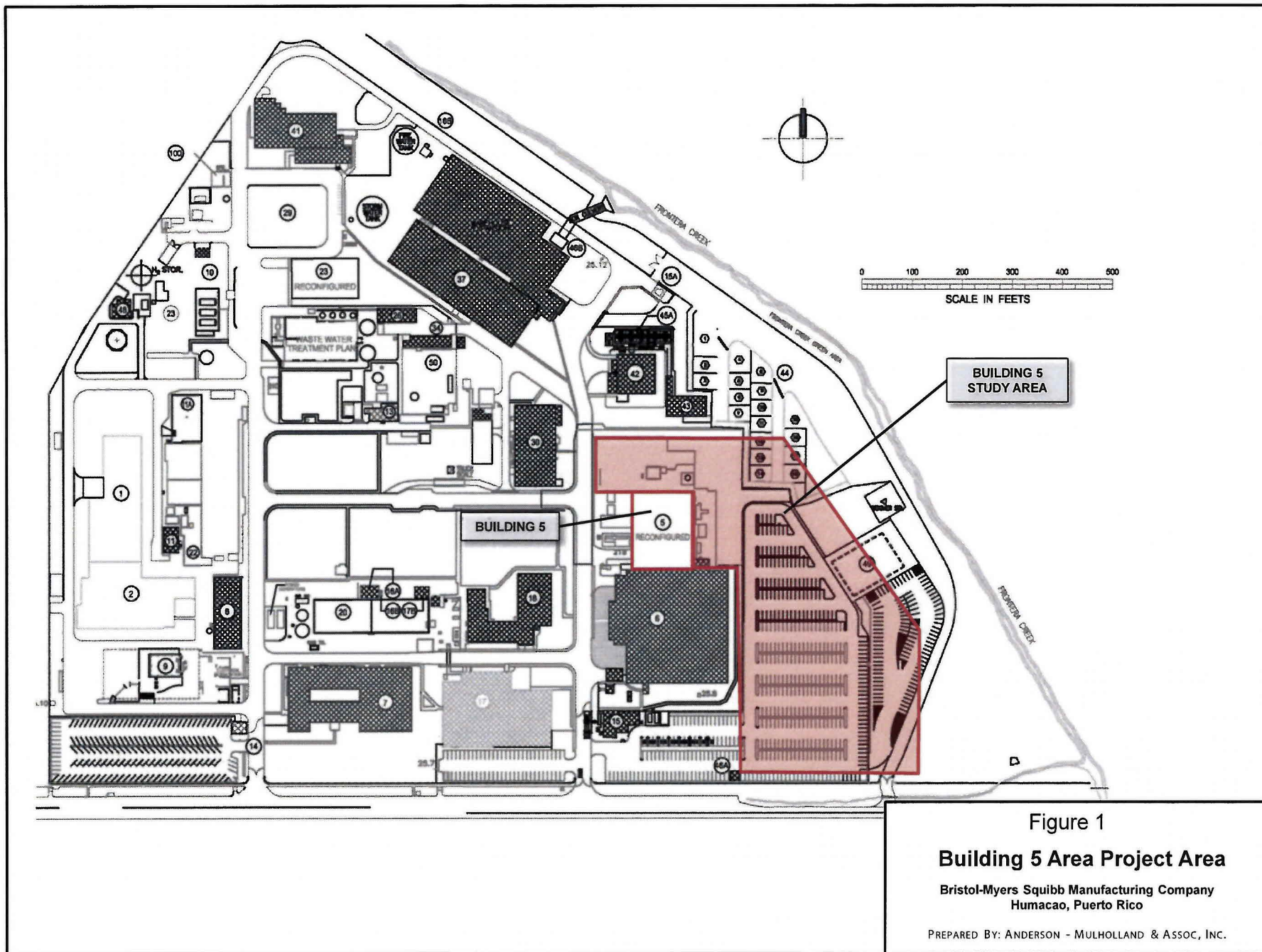
NA - Not Analyzed

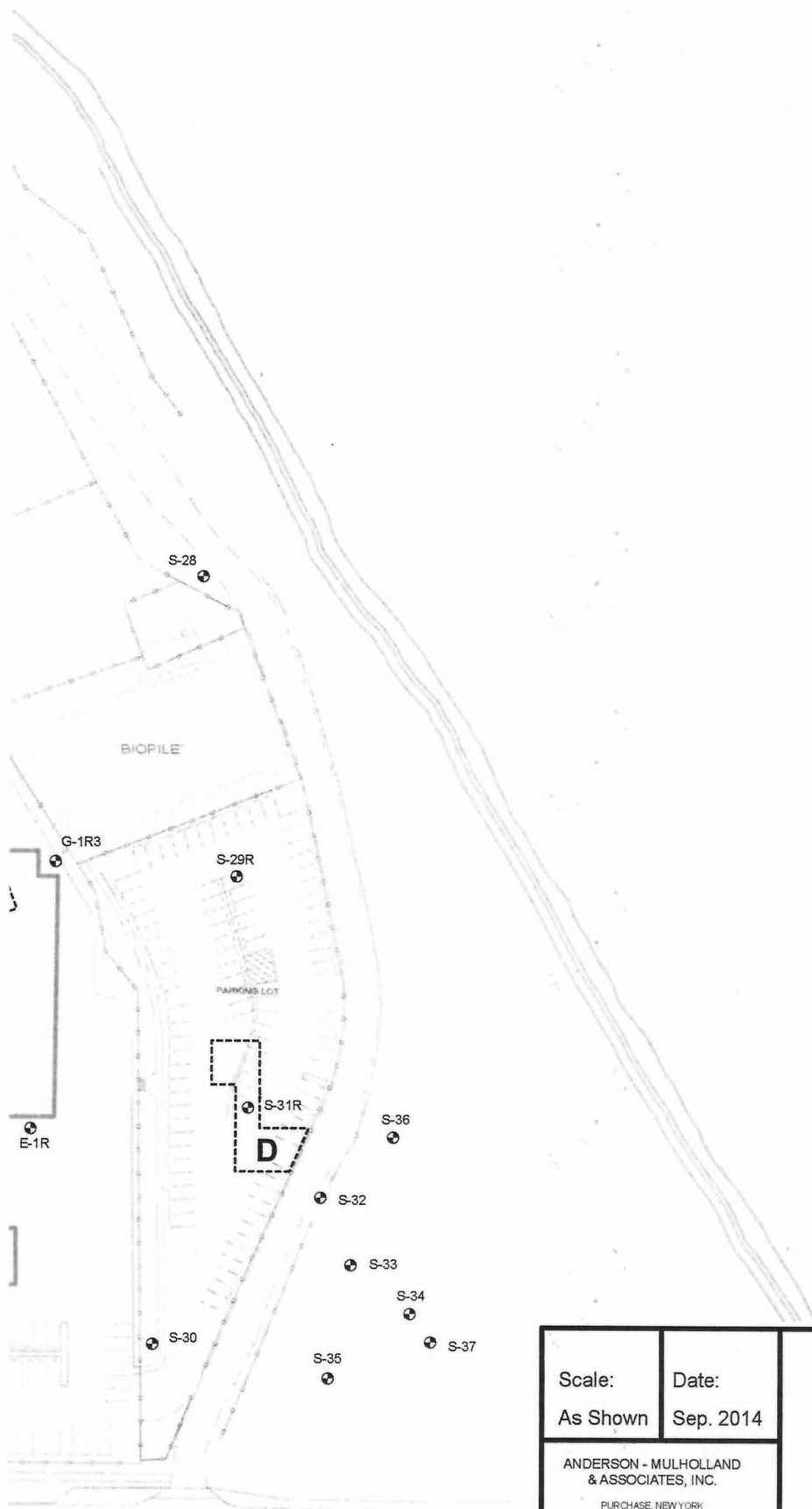
Shaded results indicate the concentration exceeds the Tier 1 Screening Level

¹Tier 1 Levels represent alternative land disposal restriction treatment standards for contaminated media (i.e., ten times the universal treatment standard) in accordance with 40 CFR §268.49(c)(1)(C).



²Tier 2 Levels represent migration to groundwater screening levels from USEPA Regional Screening Levels (January, 2015). Values shown are based on a dilution attenuation factor of 20.

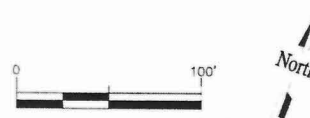
Figures





LEGEND

- S-36
 MONITORING WELL
-  EXCAVATION AREA



Scale:

As Shown

Date:

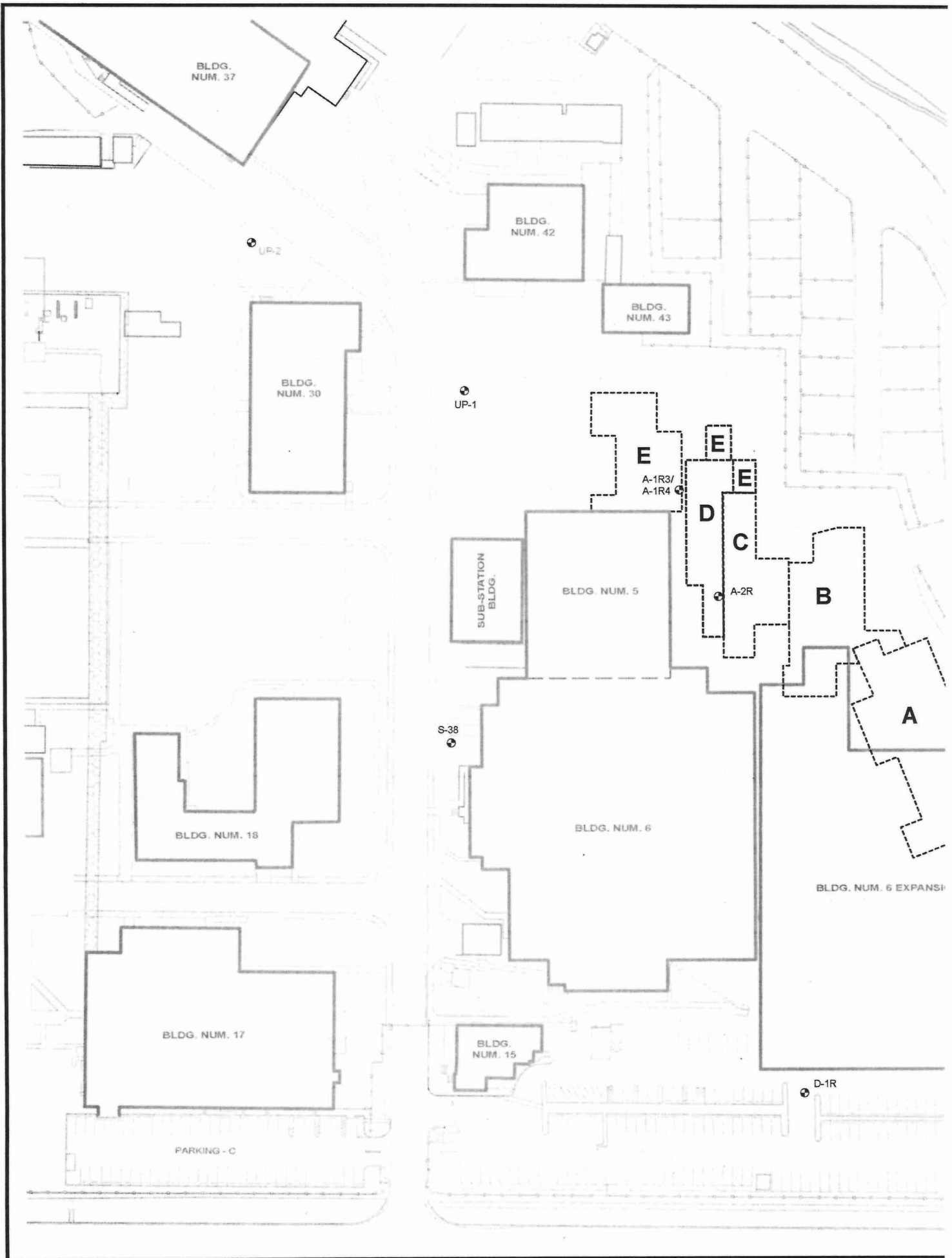
Sep. 2014

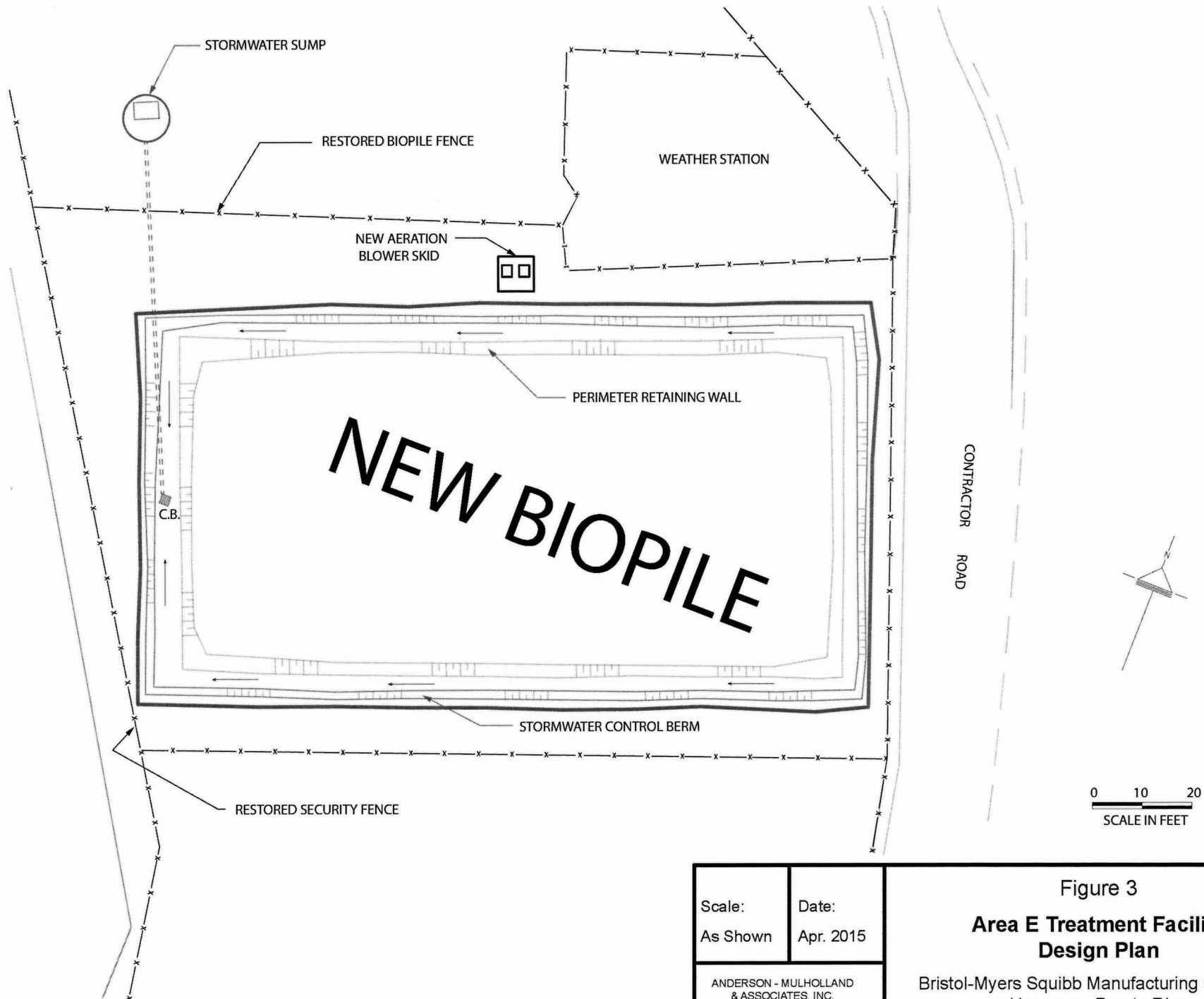
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 & ASSOCIATES, INC.
 PURCHASE, NEW YORK

Figure 2

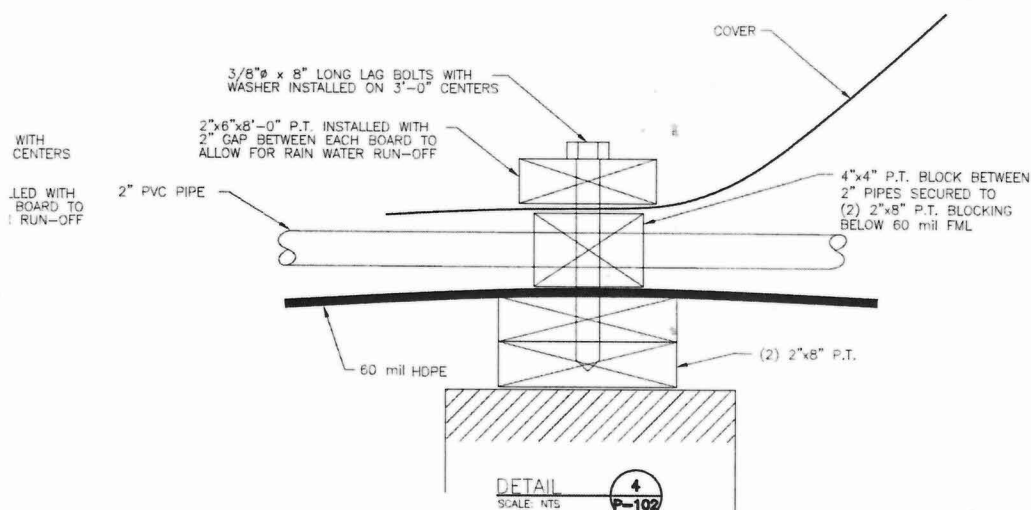
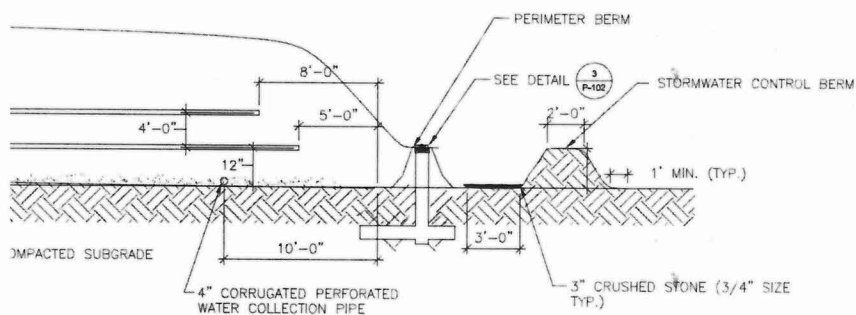
ICM Excavation Areas and Treatment Facility Location

Bristol-Myers Squibb Manufacturing Company
 Humacao, Puerto Rico





<div>Scale: As Shown</div>		<div>Date: Apr. 2015</div>	<div>Figure 3</div> <div>Area E Treatment Facility Design Plan</div> <div>Bristol-Myers Squibb Manufacturing Company Humacao, Puerto Rico</div>
<div>ANDERSON - MULHOLLAND & ASSOCIATES, INC.</div> <div>PURCHASE, NEW YORK</div>			



SCREW (TYP.)

TAPERED SILICONE
ER PLUG (TYP.)

LE DRILLED INTO PIPE
(RING PORT)

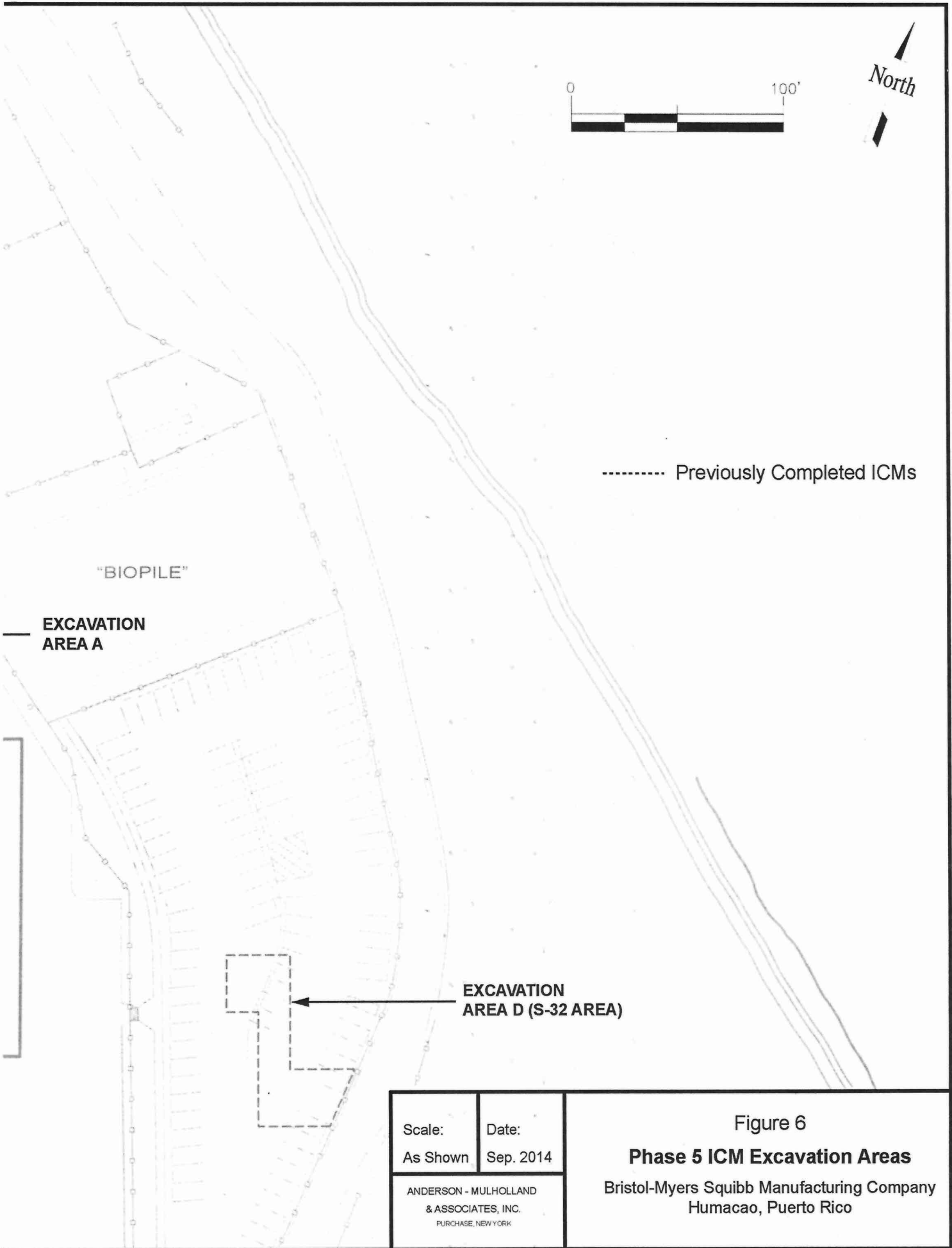
BERS

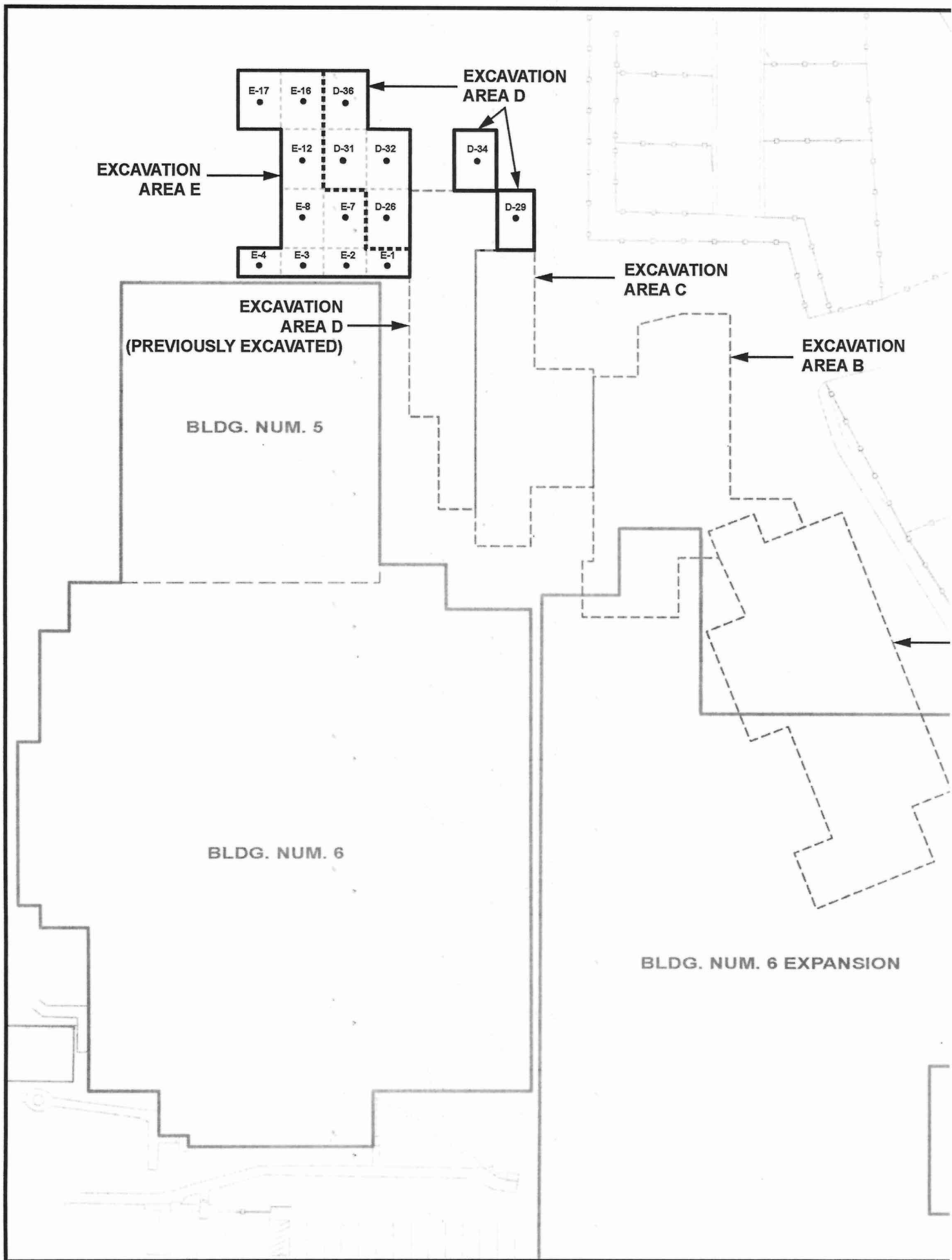
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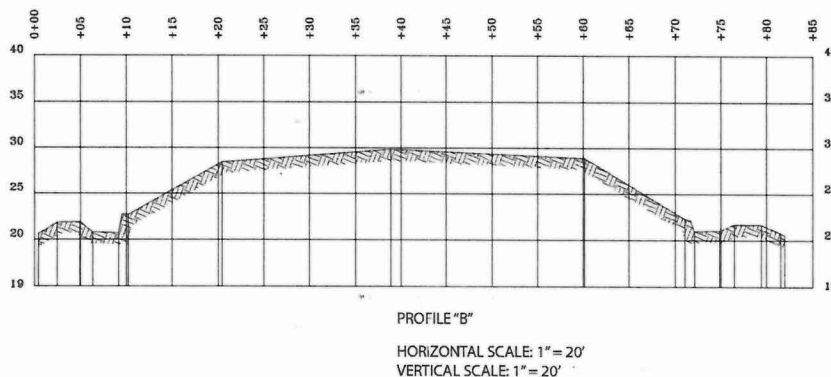
Date:
Apr. 2015

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Figure 4
**Treatment Cell Cross-Section
and Details**
Bristol-Myers Squibb Manufacturing Company
Humacao, Puerto Rico

















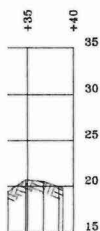


NOTES

- 1- ALL DISTANCES AND ELEVATIONS ARE IN FEET
- 2- BENCHMARK ELEVATION ON TOP OF SURVEY PK-NAIL, WASHER
LOCATED AT EAST SIDE OF BUILDING NO 18, ON TOP
OF CONCRETE SWALE ELEVATION IS 071 FEET
- 3- HORIZONTAL AND VERTICAL CONTROL REFERRED TO BRISTOL-MYERS
SQUIBB PLANT SYSTEM
- 4- THE TOPOGRAPHIC WAS SHOWN IN SPOT ELEVATION AND CONTOUR
LINE WITH INTERVAL AT 1 00 METER
- 5- ALL DRAWING AND CALCULATION FOR THIS MAP WERE DONE
USING AUTOCAD FOR WINDOWS RELEASE 2010 AND SURVCAD
FOR WINDOWS RELEASE 2010

LEGEND:

- | | |
|---|------------------------|
|  | CHAIN LINK FENCE |
|  | GUARD RAIL |
|  | CONTOUR LINE |
|  | SECTION OR ORIENTATION |
|  | BASE LINE STATION |
|  | CATCH BASIN |
|  | MONITORING WELL |
|  | SPOT ELEVATION |
|  | CROSSED POLE |
|  | GATE |
|  | CONCRETE SLAB |
|  | EMBANKMENT |



Scale:
As Shown

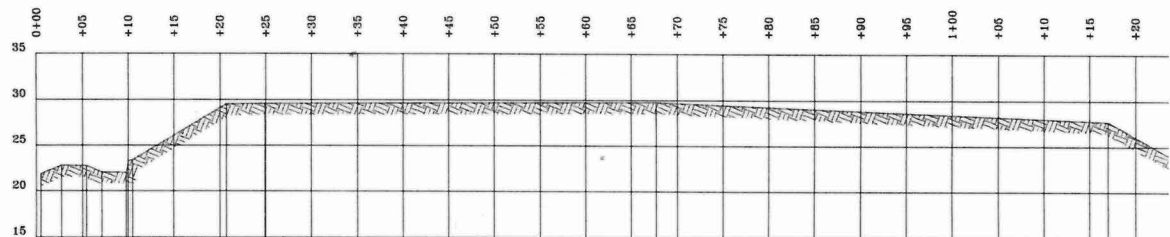
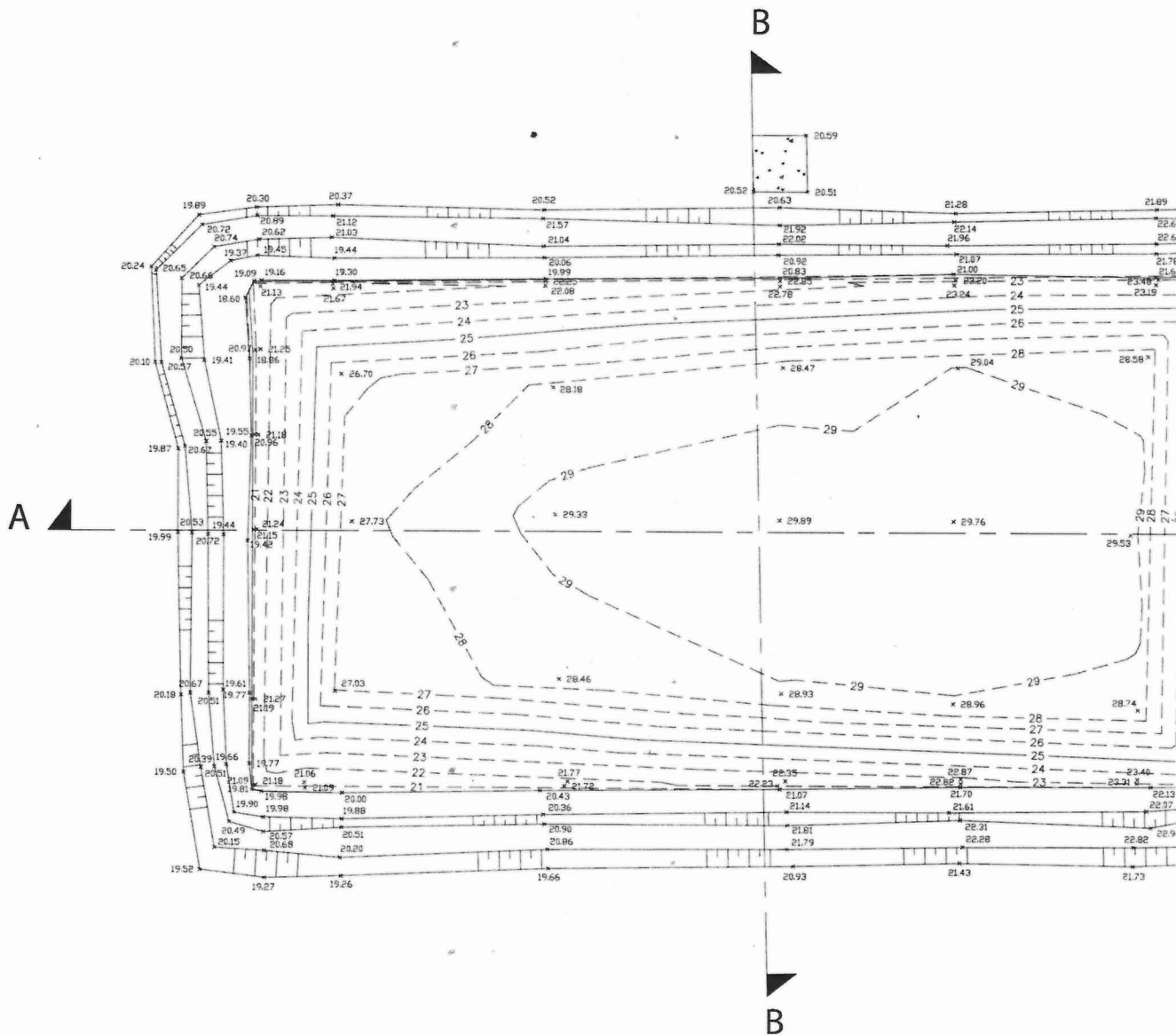
Date:
Apr. 2015

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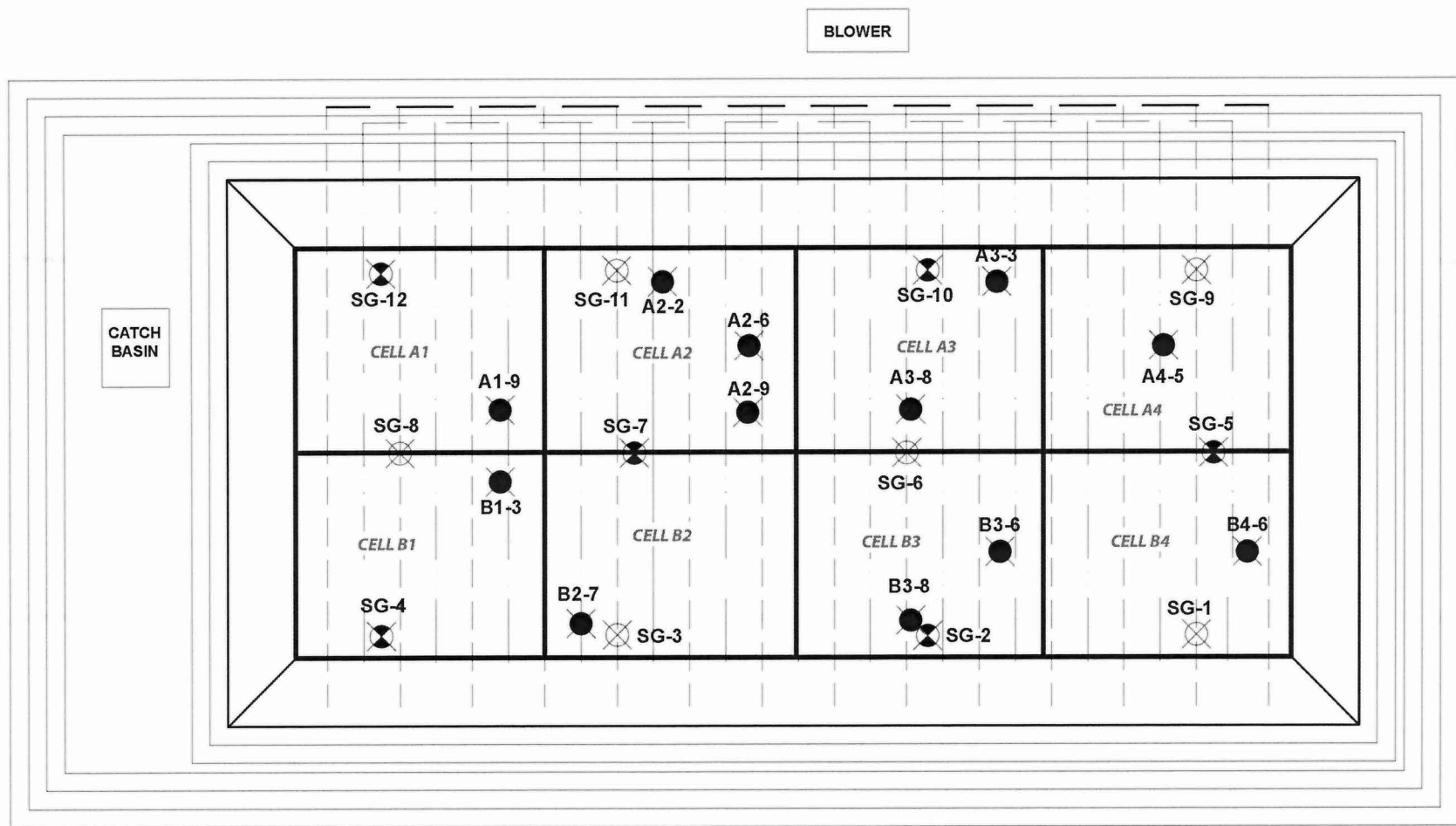
Figure 7

Biopile As-Built Plan and Cross-Sections

Bristol-Myers Squibb Manufacturing Company
Humacao, Puerto Rico



PROFILE "A"
HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 20'



LEGEND

- Lower Aeration Pipes
- Upper Aeration Pipes
- ⊗ Gas Probe - Shallow
- ⊗ Gas Probe - Deep
- Soil Sample Location

Scale:

Not to scale

Date:

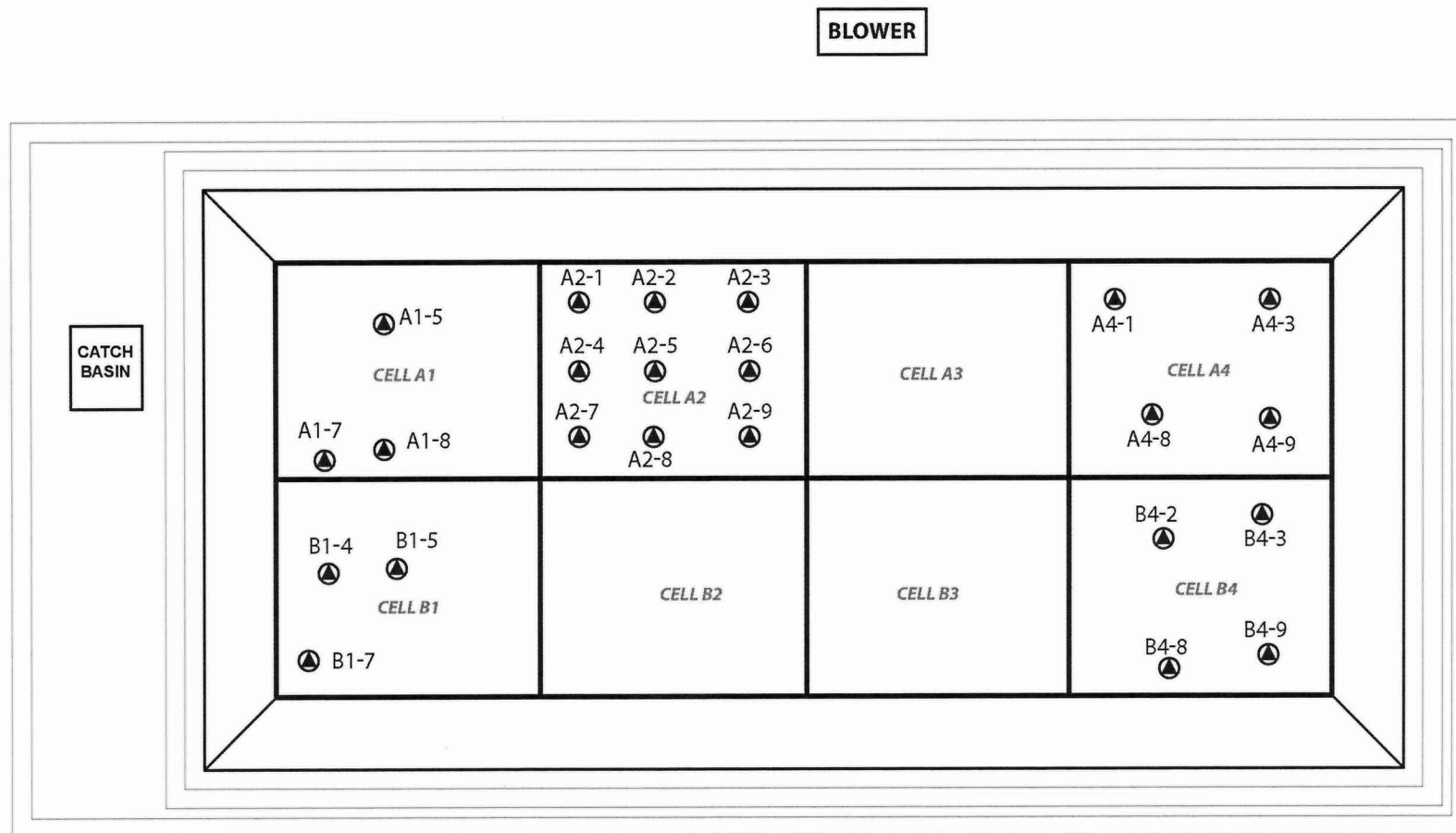
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Figure 8

Biopile Performance Sampling Locations

Bristol-Myers Squibb Manufacturing Company
Humacao, Puerto Rico



LEGEND

▲ SOIL BORING LOCATION

Scale:

Not to scale

Date:

Apr. 2015

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Figure 9

Biopile Soil Boring Locations

Bristol-Myers Squibb Manufacturing Company
Humacao, Puerto Rico

Appendix A

Photographic Documentation of Phase 5 Source Removal Activities

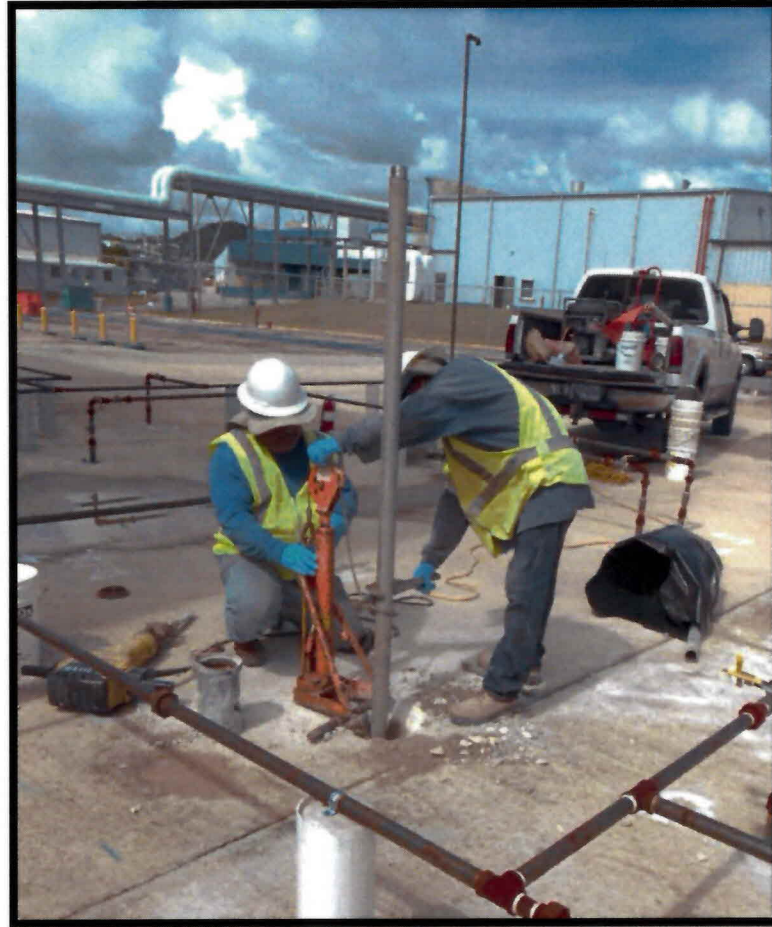
Area E – PreRemediation

Northeast side of Building 5 exterior, looking north at soil venting system constructed and operated to remove methane from the subsurface prior to the Phase 5 soil excavation. (January 18, 2013)



Area E – PreRemediation

East side of Building 5 exterior, looking northwest at the closed soil venting piping and the removal of monitoring well A-1R3. (January 24, 2013)



Area E – Pre-Remediation

North side of Building 5 looking southwest at demolished concrete within Area E. Prior to commencement of excavation, concrete, asphalt, and soil vapor venting piping were removed and placed in dump trucks for proper off-site disposal at the El Coqui industrial landfill located in Humacao, Puerto Rico.
(January 31, 2013)



Area E – PreRemediation

North side of Building 5 exterior looking southeast at demolished concrete in Area E
(January 31, 2013)



Biopile – PreRemediation

Northwest corner of Biopile looking southwest at Biopile under construction. The Biopile was constructed with a 60 mil high density polyethylene (HDPE) bottom liner placed on the graded ground surface. (January 28, 2013)



Biopile – PreRemediation

Southeast corner of Biopile looking west at Biopile under construction. The Biopile was constructed with a gravel and geotextile fabric layer over the bottom liner. The Biopile was surrounded by a plastic lined berm which collected rainwater runoff from the Biopile. (January 31, 2013)



Remediation Start

West side of Building 5 looking west at empty Biopile prior to remediation of Area E. A temporary stone ramp was constructed on the north side of the Biopile to allow heavy equipment access to the Biopile. (February 4, 2013)



Area E Remediation

North side of Building 5 exterior looking east at the Area E impacted soil removal. A 25-ton tracked excavator was used for the excavation. Soil was loaded into an 8 cubic yard dump truck and moved to the Biopile. (February 6, 2014)



Area E Remediation

North side of Building 5 exterior looking southwest at Area E impacted soil excavation cell. An odor suppressing foam was applied to impacted soil in the open excavation cell.

(February 18, 2013)



Biopile Construction

East side of Biopile looking east and impacted soil within Biopile. An odor suppressing foam was applied over uncovered soil in the Biopile during work hours. (February 18, 2013)



Area E Remediation

North side of Building 5 exterior looking west at Area E excavation. (February 19, 2013)



Biopile Construction

Southwest side of Biopile looking west at Biopile under construction. A composite cover system was installed on the Biopile consisting of a non-woven, synthetic fiber cover designed to be permeable to oxygen, carbon dioxide, and water vapor and a 30 mil high density polyethylene top cover liner to minimize infiltration of rainfall. (February 28, 2013)



Biopile Start-Up

North side of Biopile looking west at Biopile aeration headers and aeration blower skid. Aeration blowers were started on March 15, 2013
(March 15, 2013)



Biopile Operation

Biopile from Building 5 roof looking west at Biopile. (March 21, 2013)



Area E Restoration

Area E excavation area restoration from Building 5 roof looking north at the back filled excavation area. Upon completion of excavation activities, imported fill material consisting of crushed stone was placed in the excavation area and compacted. The excavation area was restored to its previous condition with re-enforced concrete. (March 21, 2013)



Appendix B

2012 Building 5 Supplemental Soil Investigation

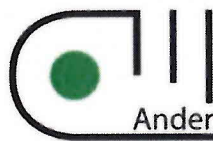


Bristol-Myers Squibb Manufacturing Company

***Building 5 Area
Supplemental Soil Investigation Report***

***Bristol-Myers Squibb Manufacturing Company
Humacao, Puerto Rico***

February 2012



Anderson Mulholland & Associates
ENVIRONMENTAL CONSULTANTS

***Building 5 Area
Supplemental Soil Investigation Report***

Bristol-Myers Squibb Manufacturing Company

Humacao, Puerto Rico

February 2012

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Appendices

- A Building 5 Area Supplemental Soil Boring Logs

**B Building 5 Area Supplemental Soil and Soil Vapor Investigation Analytical
Laboratory and Data Validation Reports (on CD)**

1.0 Introduction

This report presents the results of the supplemental soil and soil vapor investigations conducted in the Building 5 Area (Solid Waste Management Unit No. 20) at the Bristol-Myers Squibb Manufacturing Company (BMSMC) facility in Humacao, Puerto Rico. The objective of the supplemental investigation was to further delineate light non-aqueous phase liquid (LNAPL) impacts north of Building 5 in an area where BMSMC is planning a building expansion. Previous investigations completed from 1995 through 2011, which included soil, soil gas, groundwater sampling, and a LNAPL investigation identified impacts in the area north of Building 5. Results of the LNAPL investigation conducted in 2011 were provided to the USEPA in the *LNAPL Investigation Summary Report Building 5 Area* (AMAI, 2011a). In addition, a portion of the planned Building 5 expansion area was characterized in 2007 as part of the Area C and D Pre-Design Soil Investigation (AMAI, 2007). The planned Building 5 expansion area and the Area C and Area D removal areas are shown on **Figure 1**.

The supplemental soil and soil vapor investigations were completed as part of an on-going RCRA Corrective Action Program at the Humacao facility. The initial *Corrective Measures Study (CMS) Report Building 5 Area* was submitted to EPA in August 2001. The 2001 CMS Report addressed the distribution of acetone, benzene, ethylbenzene, toluene, xylene, methyl isobutyl ketone (MIBK), methanol, and isopropyl alcohol in soil and groundwater at the Building 5 Area. These compounds were identified as constituents of concern (COCs) based on the use of Building 5 as a bulk chemical manufacturing facility that produced intermediate and final bulk pharmaceuticals. BMSMC submitted a revised CMS report to the USEPA in June 2007 that provided recommendations for the Final Corrective Measure. The recommended corrective measure included a combination of source area excavation and monitored natural attenuation (MNA). An updated CMS report was submitted to the USEPA in July 2011 that documented the improving groundwater quality in the area and provided recommendations for the Final Corrective Measure for the Building 5 Area (AMAI 2011b). The recommended corrective measure for groundwater is MNA.

1.1 Supplemental Soil Investigation

The Building 5 Area supplemental soil investigation was conducted from December 5, 2011 through December 8, 2011 in accordance with the November 2011 *Scope of Supplemental Soil Investigation Building 5 Area* (AMAI 2011c). Seventeen soil borings (I-1 through I-9 and I-12 through I-19) were completed within the footprint of the planned Building 5 expansion. Footprint soil borings were located within the center of 20-foot by 28-foot cells, similar to the grid used during the Area C and D pre-design soil

investigation. Soil borings I-10 and I-11 were not completed due to shallow refusal at approximately 4-feet and 1-foot below ground surface (bgs), respectively.

Nine soil borings (P-1 through P-9) were completed along the perimeter of the planned Building 5 expansion area to evaluate soil conditions where subsurface activities might occur during building construction. Perimeter soil borings were spaced along approximate 30-foot centers that corresponded to the intersection of the planned column lines at the planned expansion building's perimeter. The approximate locations of the footprint and perimeter soil borings are provided in **Figure 2**.

Prior to sampling, each footprint and perimeter soil boring location was cored using a concrete coring device. The concrete core was placed back in the corehole and sealed until drilling at that location commenced. Prior to drilling, the seal was removed and an organic-vapor analyzer (OVA) equipped with a photoionization detector (PID) was used to measure and record the soil vapor within the headspace. Pre-drilling headspace measurements are included on the boring logs provided in **Appendix A**.

Footprint soil borings were continuously sampled using direct-push methods (Geoprobe[®]) from the surface to a minimum depth of 12 feet bgs. Perimeter soil borings were advanced to a depth of eight feet bgs. Boring logs are provided in **Appendix A**.

Each four-foot soil core was reviewed by the geologist for evidence of impacts and screened with a PID. Soil samples were collected and analyzed by Accutest Laboratories (Accutest) of Dayton, New Jersey for the following compounds:

Parameter	Analytical Method
Acetone	SW846 – Method 8260B
Benzene	SW846 – Method 8260B
Ethylbenzene	SW846 – Method 8260B
Toluene	SW846 – Method 8260B
Xylene ¹	SW846 – Method 8260B
MIBK	SW846 – Method 8260B
Methanol	SW846 – Method 8015
Isopropyl Alcohol	SW846 – Method 8015

One soil sample was collected from each footprint and perimeter soil boring location. Soil samples were collected from the intervals most visibly impacted or at which the highest PID readings were observed.

¹ Represents the total concentration of the o-, m-, and p-xylene isomers

Each laboratory analytical sample was validated according to the following USEPA guidance documents:

- *USEPA Region 2, SOP HW-24, Standard Operating Procedure for the Validation of Organic Data Acquired using SW-846 Method 82608 (August 2009-Revision 2)*
- *USEPA National Functional Guidelines for Low/Medium Concentration Organic Data Review (SOW SOM01.2 SOP HW-33, August 2009 - Revision 2)*
- *USEPA National Functional Guidelines for Organic Data Review for Low Concentration Water (SOP HW-13, August 2009-Revision 3).*

Analytical laboratory reports and data validation reports are provided in **Appendix B** (on CD). Results of the supplemental soil investigation are presented and discussed in Section 2.

1.2 Supplemental Soil Vapor Investigation

A supplemental soil vapor investigation was conducted to determine the composition of soil vapor within an area where a potential methane gas pocket was noted during the completion of the supplemental soil investigation. The supplemental soil vapor investigation was conducted on February 2, 2012 in accordance with the *Building 5 Area Soil Vapor Investigation Scope of Work* (AMAI, 2012). Two soil borings (I-7A and A-1R3A) were completed adjacent to I-7 and monitoring well A-1R3, respectively. The approximate locations of I-7A and A-1R3A are shown on **Figure 2**. Boring logs are provided in **Appendix A**.

Prior to sampling, each soil vapor boring location was cored using a concrete coring device. Direct push drilling methods (Geoprobe[®]) were used to collect one shallow soil sample from three to five feet bgs and three soil vapor samples from five to 11 feet bgs. The shallow soil sample was collected using a 2-inch diameter macrocore sampler. The soil core was reviewed by the geologist for evidence of impacts and screened with a PID. A soil sample was collected for analysis from the interval most visibly impacted or at which the highest PID readings were observed. Soil samples were submitted to Accutest and analyzed for the following same compounds listed in Section 1.1

For the soil vapor sampling, the Geoprobe[®] was equipped with Post Run Tubing (PRT) system. The PRT system was outfitted with a polyvinyl chloride (PVC) non-sparking expendable drive point and driven to the target depth for soil vapor collection. At each boring location, soil vapor samples were collected from 5 to 6 feet bgs and from 7 to 8 feet bgs. Soil vapor samples were collected through 0.25-inch polyethylene tubing attached to a Landtech Gem2000[™] portable landfill gas analyzer capable of measuring percent methane, percent oxygen, percent carbon dioxide, and percent lower explosive

limit (LEL) for methane. The gas analyzer was equipped with an in-line charcoal filter to screen out non-methane organic compounds (NMOCs). Organic vapor readings were collected with a PID meter and the passive flow rate within the tube was measured using a dry piston flow meter. Screening at each location continued until the monitoring parameters stabilized.

Below 8 feet bgs, the PRT system was equipped with a 21-inch stainless-steel soil vapor implant. For each boring the implant was installed from 9.25 to 11 feet bgs, which corresponded to the zone where soil impacts were observed during the Supplemental Soil Investigation. Saturated conditions were encountered at approximately 10 feet bgs and groundwater began to rise quickly within the borehole. Under these conditions, the soil vapor implant became saturated, which precluded the collection of a discrete soil vapor sample at 9.25 to 11 feet bgs. The soil vapor implant was raised within the borehole to approximately 3.5 feet bgs until it was above the static water level of 4 feet bgs. Soil vapor screening values for methane, oxygen, carbon dioxide, LEL, total VOCs, and passive flow rate were measured and recorded after each parameter stabilized. A one-liter stainless steel canister equipped with a 5-minute flow controller was then connected to the PRT tubing to collect a sample for offsite laboratory analysis for the following parameters:

Parameter	Analytical Method
Acetone	USEPA Compendium Method TO-15
Benzene	USEPA Compendium Method TO-15
Ethylbenzene	USEPA Compendium Method TO-15
Toluene	USEPA Compendium Method TO-15
Xylene	USEPA Compendium Method TO-15
MIBK	USEPA Compendium Method TO-15
Isopropyl Alcohol	USEPA Compendium Method TO-15
Methane	USEPA Compendium Method TO-3

Soil vapor screening for methane, oxygen, carbon dioxide, LEL, total VOCs, and passive flow rate was also conducted in the headspace in monitoring well A-1R3.

Analytical laboratory and data validation reports for samples collected during the supplemental soil vapor investigation are provided in **Appendix B** (on CD). Results of the supplemental soil vapor investigation are presented and discussed in Section 2.

2.0 Results

The following discussion presents the results of the Building 5 Area supplemental soil and soil vapor investigations. Where appropriate, results are discussed in context with the overall Corrective Measures Study.

The subsurface physical conditions encountered during the Building 5 Area Supplemental Soil Investigation were similar to the conditions described in previous reports (AMAI 2007, AMAI 2011b). Fill material, which was encountered in each soil boring, consists of a variable mixture of gravel, sand, and clay that was generally dry to moist. The thickness of the fill varied from four to eight feet with an average thickness of around five feet. The fill unit was underlain by interbedded fine to coarse sand and silty-clay. Moisture conditions in this unit ranged from moist to wet. A silty-clay confining layer was noted at a depth between 14 and 15 feet in borings that were advanced below 12 feet. Depth to groundwater in this area of the site has historically ranged from two to six feet.

Results for the footprint and perimeter soil borings are discussed below.

2.1 Footprint Soil Boring Sampling Results

Seventeen of 19 proposed soil borings were completed within the footprint of the planned Building 5 expansion area (**Figure 2**). As noted above, soil borings I-10 and I-11 were not completed due to shallow refusal. Two additional soil borings (I-7A and A-1R3A) were completed within the planned Building 5 expansion area as part of the supplemental soil vapor investigation (**Figure 2**). Observations and soil analytical results from these borings are included in the following discussion.

Odors, described as VOC-like, were identified in a number of soil borings located within the footprint of the planned Building 5 expansion. Moderate to strong odors were typically noted below four feet in fine to coarse-grained material that was described as moist to wet. In general, strong odors were associated with PID reading above 1000 ppm, while moderate odors were associated with PID readings between 100 ppm and 1000 ppm. A hydrocarbon film was identified in borings I-2 (13 feet bgs), I-7 (12 feet bgs), and I-17 (9 feet bgs). In each of these borings, the hydrocarbon film was present in medium to coarse-grained sand.

A temporary piezometer was installed in I-2 to determine if LNAPL was associated with the presence of the hydrocarbon film. The temporary piezometer was screened from 6 feet to 16 feet and left in-place for two days. An oil-water interface probe and clear bailer were used to determine if LNAPL had accumulated in the temporary piezometer. LNAPL was not observed or detected in I-2 over the two-day period that the temporary

piezometer was installed. Other than the hydrocarbon films mentioned above, LNAPL was not observed in any soil borings completed within the footprint of the planned Building 5 expansion. These observations, as well as the soil analytical results discussed below, support the conclusion that the LNAPL present near monitoring well A-1R3 is of limited extent (AMAI, 2011a).

Twenty soil samples, including two duplicate samples, were collected from the borings completed in the footprint area of the planned Building 5 expansion. An analytical sample was not collected from boring I-1, as I-1 appeared to be located within a structure that was backfilled with sand and gravel. Samples for analytical characterization were collected from the interval most visibly impacted or at which the highest PID reading was observed. **Table 1** presents the minimum detected concentration, maximum detected concentration, and number of samples with a detected concentration for each of the Building 5 COCs. In addition, Tier 1 and Tier 2 soil screening levels (SSLs) are provided for comparison purposes. Tier 1 screening levels represent alternative land disposal restriction treatment standards for contaminated media (i.e., ten times the universal treatment standard) in accordance with 40 CFR §268.49(c)(1)(C). Tier 2 screening levels are more stringent than Tier 1 screening levels and represent 20 times the protection of groundwater SSL based on the November 2011 USEPA Regional Screening Levels (RSL). COCs for which the maximum concentration exceeds Tier 2 screening levels are shaded in **Table 1**.

Each of the Building 5 COCs was detected in at least one sample. Xylene was the most prevalent COC detected (17 out of 20 samples) followed by ethylbenzene and acetone (15 out of 20 samples). Except for benzene, the maximum concentration of each COC exceeded the Tier 2 screening level. The maximum concentration of ethylbenzene, toluene, xylene, and MIBK also exceeded their respective Tier 1 screening levels. Tier 1 and Tier 2 screening are not available for isopropyl alcohol (IPA).

Table 2 presents the sample identification, sample date, sample depth, validated analytical results, and appropriate data qualifiers for soil samples collected within the footprint of the planned Building 5 expansion. Concentrations that exceed the Tier 2 screening level are shaded in **Table 2**.

Of the COCs that exceeded Tier 2 screening levels, xylene concentrations ranged from non-detect in I-5, I-6, and I-7A to 5550 mg/kg in I-17 (10-11 feet bgs). Ethylbenzene concentrations ranged from non-detect in I-5, I-6, I-7A, I-8, and I-8D to 1710 mg/kg in I-17. Toluene concentrations ranged from non-detect in I-5, I-6, I-7A, I-8 (D), I-9, I-13, I-14, I-15, I-16, I-18, I-19, and A-1R3A to 444 mg/kg in I-3. MIBK concentrations ranged from non-detect in I-5, I-6, I-7A, I-8, I-9, I-13, I-14, I-15, I-18, I-19, and A-1R3A to 1080

mg/kg in I-7. Acetone concentrations ranged from non-detect in I-6, I-7A, I-9, I-16, and I-17 to 115 mg/kg in I-4. Methanol concentrations ranged from non-detect in I-3, I-5, I-6, I-7A, I-8 (D), I-9, I-12, I-14, I-15, I-16, I-18, I-19, and A-1R3A to 1050 mg/kg in I-7. Although there is no screening level for IPA, IPA concentrations ranged from non-detect in I-3, I-5, I-6, I-7A, I-8 (D), I-9, I-12, I-14, I-15, I-16, I-18, I-19, and A-1R3A to 500 mg/kg in I-7.

A comparison of the compounds detected in soil to the Tier 1 and Tier 2 soil screening levels is provided in **Table 2** and illustrated in **Figure 3**. Xylene concentrations exceeded the Tier 2 screening level (196 mg/kg) at six locations (I-2, I-3, I-4, I-7, I-12, and I-17) and the Tier 1 screening level (300 mg/kg) at five locations (I-3, I-4, I-7, I-12, and I-17). Soil borings I-2, I-3, and I-4 were located adjacent to Building 5 and soil borings I-7, I-12, and I-17 were located northwest of monitoring well A-1R3. The highest concentration of COCs was detected in boring I-7 at a depth of 10-11 feet bgs. The distribution of the other COC concentrations above their Tier 1 and Tier 2 screening levels is similar to the distribution of elevated xylene concentrations.

2.2 Perimeter Boring Sampling Results

Nine soil borings (P-1 through P-9) were completed along the perimeter of the planned Building 5 expansion to evaluate conditions where subsurface activities may potentially occur (**Figure 2**). Each perimeter soil boring was advanced to a depth of eight feet bgs. Except for soil boring P-9, no odors to slight odors were noted in the perimeter soil borings. Strong VOC-like odors and elevated PID readings (greater than 1500 ppm) were noted from four to eight feet bgs in soil boring P-9. P-9 was located within the previously defined Area D excavation area. Visual impacts (e.g. staining, sheen, etc.) were not observed in any of the perimeter soil borings.

Nine soil samples (one from each soil boring) were collected from the perimeter soil borings. Samples for analytical characterization were generally collected from the interval of highest PID readings. **Table 3** presents the minimum detected concentration, maximum detected concentration, and number of samples with a detected concentration for each of the Building 5 COCs. In addition, Tier 1 and Tier 2 SSLs are provided for comparison purposes. Each of the Building 5 COCs was detected in at least one perimeter soil boring. Ethylbenzene and xylene were the most prevalent COCs detected (seven out of nine samples). Acetone was detected in six out of nine samples and methanol was detected in five out of nine samples. The maximum concentration of ethylbenzene, xylene, and MIBK exceeded their respective Tier 1 and Tier 2 screening levels.

Table 4 presents the sample identification, sample date, sample depth, analytical results, and appropriate data qualifiers for perimeter soil samples. The distribution of COCs in the perimeter soil borings is illustrated in **Figure 4**. Ethylbenzene, xylene, and MIBK concentrations exceeded their respective Tier 2 screening levels in only one soil boring (P-9). P-9 was located north of the Area D removal area location near previously identified soil impacts (**Figure 4**). Ethylbenzene concentrations in other perimeter soil borings ranged from non-detect P-2 and P-8 to 3.83 mg/kg in P-5. Xylene concentrations in other perimeter soil borings ranged from non-detect in P-2 and P-8 to 11.8 mg/kg in P-5. MIBK concentrations in other perimeter soil borings ranged from non-detect P-1, P-2, P-3, P-4, P-6, P-7, and P-8 to 0.195 mg/kg in P-5.

2.3 Estimated Extent and Volume of Impacted Soil

Results and observations from the 2011 Supplemental Soil Investigation and the 2007 Area C and D Pre-Design Investigation (AMAI 2007) were used to estimate the extent and volume of impacted soil. Specifically, soil analytical data, PID readings and visual and olfactory indications of impacts were used to estimate the extent and volume of soil impacts.

Vertical profiles for each cell were developed to illustrate the extent of likely clean, potentially impacted, and impacted soil intervals. Profiles were arranged along four east-west trending transects (Transect A through Transect D) through the supplemental soil investigation area and the portion of Area D where impacted soil remained in-place. Each profile contains PID readings, xylene concentration of analytical samples, depth at which the analytical sample was collected, and field observations of the magnitude of odors. The estimated volume of impacted soil is also provided for each cell. Transect A, which is located adjacent to Building 5 and includes cells I-1 through I-6 and P-1, is illustrated in **Figure 5**. Transect B, which includes cells I-7 through I-11, P-2, D-26/A-1R3, and D-27 through D-29, is illustrated in **Figure 6**. The impacted soil removed from cells D-27 and D-28 during the Area D removal is also shown on **Figure 6**. Transect C, which includes cells I-12 through I-15, P-3, P-9, and D31 through D-35, is illustrated in **Figure 7**. Transect D, which is the northernmost transect and includes cells I-16 through I-19, P4, P5, P8, D-36, and D-37 is illustrated in **Figure 8**.

The designation of clean, potentially impacted soil, and impacted soil was based on the following criteria:

- Clean Soil
 - Soil in which the concentration of each COC was less than the Tier 2 screening level

- Soil intervals for which analytical data are not available, no odors to slight odors were typically noted, and PID readings were generally less than 500 ppm
- Potentially Impacted Soil
 - Soil intervals above impacted soil, for which analytical data are not available, slight odors to moderate odors were typically noted, and PID readings were generally greater than 500 ppm
- Impacted Soil
 - Soil in which the concentration of at least one COC was greater than the Tier 2 screening level
 - Soil intervals for which analytical are not available, moderate to strong odors were typically noted, and PID readings were generally greater than 1000 ppm

In **Figure 5** through **Figure 8**, potentially impacted soil intervals are shaded green and impacted soil intervals are shaded red. Impacted soil was identified in cells I-1 through I-4, I-7, I-8, I-12, I-16, I-17, D-34/P-9, D-26/A-1R3, D-29, D-31, D-32, and D-36. Where present, the top of impacted soil was generally between four and eight feet deep and extended to a depth of 12 to 15 feet. Impacted soil above four feet was limited to cells I-1 and I-4. Potentially impacted soil was identified in cells I-2, I-3, I-7, I-8, I-12, D-34/P-9, D-31, and D-32.

The estimated thickness and volume of impacted and potentially impacted soil within each cell is provided in **Table 5**. The estimated volume of impacted soil within impacted cells ranges from 21 cubic yards in cells D-31 and D-36 to 187 cubic yards in cell D-29. The total estimated volume of impacted soil is approximately 1250 cubic yards. The total estimated volume of potentially impacted soil is approximately 450 cubic yards.

The areal distribution of impacted soil is illustrated in **Figure 9**. The estimated volume of impacted soil within each cell is also provided in **Figure 9**. Impacted soil is located in cells adjacent to Building 5 (I-1 through I-4), cells near the LNAPL associated with monitoring well A-1R3 (D-26, I-7, I-8), cells located north and northwest of the LNAPL area (I-12, D-31, D-32, I-16, I-17, and D-36), and cells located north (D-34/P-9) and east (D-29) of the Area D removal area that remains in-place.

2.4 Soil Vapor Sampling Results

During the drilling of I-7, a loud gargling sound in the borehole was noted after the 8 to 12 foot sample was collected. Saturated conditions within medium to coarse sand were noted at approximately 10 feet in the 8 to 12 foot sample. Conditions within the borehole based on Multigas and PID readings indicated the following levels:

- 100% lower explosive limit (LEL)
- 4.7 % oxygen
- 189 ppm CO
- 5 ppm H₂S
- 950 ppm total VOCs (PID)

Soil boring I-7 was not advanced deeper than 12 feet due to the potentially explosive conditions within the borehole.

Two soil borings (I-7A and A-1R3A) were completed adjacent to boring I-7 and monitoring well A-1R3, respectively, to determine the composition of soil vapor within an area where a potential methane gas and potentially explosive soil vapor conditions were noted during the completion of the supplemental soil investigation. **Table 6** presents the sample identification, sample date, sample depth, validated analytical results, and appropriate data qualifiers for soil vapor samples collected during the supplemental soil vapor investigation. Results of the soil vapor screening and analytical results are illustrated in **Figure 10** and discussed below. Associated soil analytical results are also presented in **Figure 10**.

Elevated methane and carbon dioxide concentrations were identified in boring I-7A at a depth of 5 to 6 feet bgs and within the headspace of monitoring well A-1R3. The soil vapor sample collected at a depth of 5 to 6 feet in boring I-7A contained approximately 80% methane and 20% carbon dioxide. This sample was collected within the unsaturated sand unit just below a confining silty-clay layer. A positive (upward) passive flow rate of 330 ml/min was measured at the 5 to 6 foot bgs interval.

Below six feet, the methane and carbon dioxide concentrations in boring I-7A were each less than 1.5%. As a result of the gargling sound noted during the completion of boring I-7 and elevated COC concentrations in soil collected from 10 to 11 feet bgs in I-7, a soil vapor sample for offsite analysis was collected immediately above the water table to determine the composition of vapors that may outgas from groundwater. Results of the soil vapor sample indicate each of the Building 5 COCs as well as methane was present in the soil vapor. Vapor concentrations ranged from 0.997 mg/m³ for benzene to 4740 mg/m³ for xylene. Other COCs detected above a concentration of 1000 mg/m³ included ethylbenzene (1950 mg/m³) and MIBK (3340 mg/m³). Methane was detected at a concentration of 1540 mg/m³. No gargling sound was noted during the completion of boring I-7A.

Methane, carbon dioxide, and oxygen levels in soil vapor samples collected in monitoring well A-1R3 were similar to values measured in ambient air. A headspace sample

collected above the static water level in monitoring well A-1R3, however, contained approximately 69 percent methane and 21.5 percent carbon dioxide. A positive (upward) passive flow rate of approximately 50 ml/min was measured within the headspace of monitoring well A-1R3. Similar vapor concentrations to boring I-7A were detected in the vapor sample collected above the groundwater in boring A-1R3A. Vapor concentrations ranged from 143 mg/m³ for isopropyl alcohol to 4010 mg/m³ for xylene. Benzene was not detected above the reporting limit and methane was detected at a concentration of 783 mg/m³.

Based on the results of the soil and soil vapor sampling in the area of boring I-7 and monitoring well A-1R3, it appears that methane is being produced at depth by the anaerobic biodegradation of the Building 5 COCs in soil and groundwater. The presence of high concentrations of methane indicates that anaerobic biodegradation is occurring in this area. Near boring I-7, methane has apparently migrated upward and is being trapped under the silty clay layer present from 2 to 4 feet bgs. Near monitoring well A-1R3, methane appears to be migrating upward through the monitoring well, which provides a preferential pathway for methane migration.

3.0 Summary and Conclusions

- A supplemental soil investigation was completed to delineate soil impacts within the planned Building 5 expansion area to determine the composition of soil vapor within an area where a potential methane gas pocket was noted during the completion of the supplemental soil investigation.
- Nineteen soil borings were completed within the footprint of the planned building expansion and nine soil borings were completed along the perimeter of the planned building expansion.
- Twenty-nine soil samples were collected and analyzed for the Building 5 COCs.
- The supplemental soil vapor investigation included the collection of two soil vapor samples for offsite laboratory analysis, and soil vapor screening for methane, oxygen, carbon dioxide, LEL of methane, total VOC concentration, and passive flow rate.
- Analytical results indicate that COC concentrations in a number of cells exceed Tier 1 and Tier 2 screening levels.
- Results of the supplemental soil investigation confirm the extent of LNAPL near monitoring well A-1R3 is of limited extent. LNAPL was not observed in any of the soil borings.
- The results of the supplemental soil investigation were used to estimate the volume of impacted soil that will be available for treatment in another temporary unit. The estimated volume of impacted soil including Area D soil is approximately 1250 cubic yards. In addition, AMAI estimates there is approximately 450 cubic yards of potentially impacted soil.
- Results of the supplemental soil vapor investigation confirm the presence of methane in the subsurface at concentrations greater than the LEL for methane. Each Building 5 COC was detected in soil vapor samples.

4.0 Recommendations

The following recommendations are based on the results and findings of the Building 5 Area supplemental soil and soil vapor investigations:

- AMAI recommends the removal of impacted soil from the areas described above and placement in an on-site temporary unit for treatment using ex-situ bioremediation (see Figure 9). Ex-situ bioremediation was successfully used to treat similar impacted soil in the Building 5 Area during four previous removal/treatment actions.
- AMAI recommends that the methane gas present in the subsurface be vented prior to the removal of impacted soil, in accordance with applicable regulations.
- An Interim Corrective Measure (ICM) Work Plan and Design Plan will be prepared in accordance with the provisions of Module III of BMSMC's Final RCRA Hazardous Waste Treatment and Storage Permit No. PRD090021056. The Work Plan and Design Plan will address construction, operation, and maintenance of the temporary unit, soil excavation and transport, and soil treatment. In addition, the Work Plan and Design Plan will address soil venting activities to be conducted prior to the implementation of the soil removal program.

5.0 References

AMAI, 2007. Anderson, Mulholland & Associates, Inc. Area C and D Pre-Design Soil Investigation Report, Bristol Myers Squibb Manufacturing Company, Humacao, Puerto Rico, September 2007.

AMAI, 2011a. Anderson, Mulholland & Associates, Inc. LNAPL Investigation Summary Report Building 5 Area, Bristol Myers Squibb Manufacturing Company, Humacao, Puerto Rico, October 2011.

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AMAI, 2012. Anderson, Mulholland & Associates, Inc. Building 5 Area Soil Vapor Investigation Scope of Work, Bristol Myers Squibb Manufacturing Company, Humacao, Puerto Rico, January 2012.

Tables

Table 1
Summary Statistics for Footprint Soil Boring Samples
Building 5 Area Supplemental Soil Investigation
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COC	Tier 1 RCRA Subtitle D ¹ (mg/kg)	Tier 2 USEPA RSLs ² (mg/kg)	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Number of Detections (out of 20)
Acetone	1600	48	0.0077	127	15
Benzene	100	0.052	0.00031	0.0335	10
Ethylbenzene	100	15.6	0.00031	1710	15
Toluene	100	13.8	1.06	444	7
Xylene (total)	300	196	0.00088	5550	17
MIBK	330	4.6	0.249	1080	8
Isopropyl Alcohol	NA	NA	1.22	500	7
Methanol	7.5 mg/l (TCLP)	32	0.301	1050	6

NOTES:

¹Tier 1 Levels represent alternative land disposal restriction treatment standards for contaminated media (i.e., ten times the universal treatment standard) in accordance with 40 CFR §268.49(c)(1)(C).

²Tier 2 Levels represent migration to groundwater screening levels from USEPA Regional Screening Levels (November, 2011). Values shown are based on a dilution attenuation factor of 20.

NA: Screening level not developed for this COC

Shaded value indicates maximum concentration is greater than the Tier 2 RSL

Table 2
COC Concentrations in Footprint Soil Borings
Building 5 Area Supplemental Soil Investigation
Page 1 of 2

Boring ID			I-2	I-3	I-4	I-4 D	I-5	I-6
Sample Depth	Tier 1	Tier 2	(10-10.5)	(5-6)	(5-6)	(5-6)	(9-10)	(8.5-9.5)
Sample Date	RCRA Subtitle D ¹	USEPA RSLs ²	12/6/2011	12/6/2011	12/6/2011	12/6/2011	12/6/2011	12/6/2011
(Reporting units are in mg/kg)								
Acetone	1600	48	2.85	11.5	115	95.7	0.0233	0.012 U
Benzene	100	0.052	0.079 U	0.0192 J	0.74 U	0.76 U	0.0012 U	0.0012 U
Ethylbenzene	100	15.6	57.5	191	588	540	0.0012 U	0.0012 U
Toluene	100	13.8	54.9	444	178	210	0.0012 U	0.0012 U
Xylene (total)	300	196	229	736	2160	2000	0.0012 U	0.0012 U
MIBK	330	4.6	106	5.26	240	258	0.0061 U	0.0062 U
Isopropyl Alcohol	NA	NA	2.85	57	62	59.7	0.14 U	0.13 U
Methanol	7.5 mg/l (TCLP)	32	3.32	0.25 U	0.487	0.521	0.28 U	0.27 U

Concentrations above Tier 2 screening levels are shaded

Boring ID			I-7A	I-7	I-8	I-8 D	I-9	I-12
Sample Depth	Tier 1	Tier 2	(4-4.5)	(10-11)	(14-15)	(14-15)	(8.5-9.5)	(9.5-10.5)
Sample Date	RCRA Subtitle D ¹	USEPA RSLs ²	2/2/2012	12/6/2011	12/7/2011	12/7/2011	12/7/2011	12/7/2011
(Reporting units are in mg/kg)								
Acetone	1600	48	0.011 U	127	0.015	0.0097 J	0.012 U	69.8
Benzene	100	0.052	0.0011 U	0.0335 J	0.0015	0.0013	0.00048 J	0.06 U
Ethylbenzene	100	15.6	0.0011 U	1320	0.0012 U	0.0013 U	0.0523	361
Toluene	100	13.8	0.0011 U	64.1	0.0012 U	0.0013 U	0.0012 U	1.06
Xylene (total)	300	196	0.0011 U	4900	0.0029	0.00088 J	2.66	1270
MIBK	330	4.6	0.0055 U	1080	0.006 U	0.0063 U	0.0059 U	127
Isopropyl Alcohol	NA	NA	0.12 U	500	0.12 U	0.12 U	0.13 U	40.1
Methanol	7.5 mg/l (TCLP)	32	0.24 U	1050	0.23 U	0.23 U	0.26 U	0.23 U

Concentrations above Tier 2 screening levels are shaded

Table 2
COC Concentrations in Footprint Soil Borings
Building 5 Area Supplemental Soil Investigation
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Boring ID			I-13	I-14	I-15	I-16	I-17	I-18
Sample Depth	Tier 1	Tier 2	(12.5-13.5)	(8.5-9.5)	(5-6)	(6-7)	(10-11)	(7-8)
Sample Date	RCRA Subtitle D ¹	USEPA RSLs ²	12/7/2011	12/7/2011	12/7/2011	12/7/2011	12/8/2011	12/8/2011
(Reporting units are in mg/kg)								
Acetone	1600	48	0.0201	0.012	0.0078 J	0.57 U	30 U	0.0077 J
Benzene	100	0.052	0.0016	0.00042 J	0.00076 J	0.057 U	3 U	0.00031 J
Ethylbenzene	100	15.6	0.00031 J	0.0325	0.00038 J	1.84	1710	0.0017
Toluene	100	13.8	0.0012 U	0.0012 U	0.001 U	0.057 U	4.42	0.0011 U
Xylene (total)	300	196	0.0113	0.0826	0.0075	6.04	5550	0.0119
MIBK	330	4.6	0.0058 U	0.0059 U	0.0051 U	0.249 J	34.9	0.0053 U
Isopropyl Alcohol	NA	NA	0.12 U	0.13 U	0.12 U	0.12 U	1.22	0.11 U
Methanol	7.5 mg/l (TCLP)	32	0.731	0.25 U	0.24 U	0.23 U	0.301	0.22 U
Concentrations above Tier 2 screening levels are shaded								

Boring ID			I-19	A-1R3
Sample Depth	Tier 1	Tier 2	(8-9)	(4.5-5)
Sample Date	RCRA Subtitle D ¹	USEPA RSLs ²	12/8/2011	2/2/2012
(Reporting units are in mg/kg)				
Acetone	1600	48	0.0132	0.0296
Benzene	100	0.052	0.00051 J	0.0011 U
Ethylbenzene	100	15.6	0.0078	0.0121
Toluene	100	13.8	0.0011 U	0.0011 U
Xylene (total)	300	196	0.0232	0.0346
MIBK	330	4.6	0.0053 U	0.0054 U
Isopropyl Alcohol	NA	NA	0.12 U	0.12 U
Methanol	7.5 mg/l (TCLP)	32	0.23 U	0.25 U
Concentrations above Tier 2 screening levels are shaded				

NOTES:

¹Tier 1 Levels represent alternative land disposal restriction treatment standards for contaminated media (i.e., ten times the universal treatment standard) in

²Tier 2 Levels represent migration to groundwater screening levels from USEPA Regional Screening Levels (November, 2011). Values shown are based on a
NA: Screening level not developed for this COC

Table 3
Summary Statistics for Perimeter Soil Boring Samples
Building 5 Area Supplemental Soil Investigation
Page 1 of 1

COC	Tier 1 RCRA Subtitle D ¹ (mg/kg)	Tier 2 USEPA RSLs ² (mg/kg)	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Number of Detections (Out of 9)
Acetone	1600	48	0.0084	25.7	6
Benzene	100	0.052	0.00047	0.0462	4
Ethylbenzene	100	15.6	0.00037	488	7
Toluene	100	13.8	0.0024	1.84	2
Xylene (total)	300	196	0.00064	1750	7
MIBK	330	4.6	0.195	850	2
Isopropyl Alcohol	NA	NA	1.15	7.39	2
Methanol	7.5 mg/l (TCLP)	32	0.224	2.68	5

NOTES:

¹Tier 1 Levels represent alternative land disposal restriction treatment standards for contaminated media (i.e., ten times the universal treatment standard) in accordance with 40 CFR §268.49(c)(1)(C).

²Tier 2 Levels represent migration to groundwater screening levels from USEPA Regional Screening Levels (November, 2011). Values shown are based on a dilution attenuation factor of 20.

NA: Screening level not developed for this COC

Shaded value indicates maximum concentration is greater than the Tier 2 RSL

Table 4
COC Concentrations in Perimeter Soil Borings
Building 5 Area Supplemental Soil Investigation
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Boring ID	Tier 1	Tier 2	P-1	P-2	P-3	P-4	P-5	P-6
Sample Depth			(0.5-1.5)	(1.5-2)	(1-2)	(4-5)	(4.5-5.5)	(0-1)
Sample Date	RCRA Subtitle D ¹	USEPA RSLs ²	12/5/2011	12/5/2011	12/5/2011	12/5/2011	12/8/2011	12/5/2011
(Reporting units are in mg/kg)								
Acetone	1600	48	0.61 U	0.0088 J	0.013 U	0.0304	0.01	0.0562
Benzene	100	0.052	0.061 U	0.001 U	0.0013 U	0.00071 J	0.00047 J	0.00059 J
Ethylbenzene	100	15.6	0.911	0.001 U	0.0124	0.0186	3.83	0.0021
Toluene	100	13.8	0.061 U	0.001 U	0.0013 U	0.0013 U	0.0024	0.001 U
Xylene (total)	300	196	2.5	0.001 U	0.0046	0.0731	11.8	0.0011
MIBK	330	4.6	0.31 U	0.0051 U	0.0065 U	0.0064 U	0.195	0.0052 U
Isopropyl Alcohol	NA	NA	1.15	0.11 U	0.12 U	0.13 U	0.12 U	0.12 U
Methanol	7.5 mg/l (TCLP)	32	0.224	0.22 U	0.24 U	0.25 U	0.24 U	0.415

Concentrations above Tier 2 screening levels are shaded

Boring ID	Tier 1	Tier 2	P-7	P-8	P-9
Sample Depth			(0-1)	(4-5)	(4.5-6)
Sample Date	RCRA Subtitle D ¹	USEPA RSLs ²	12/5/2011	12/8/2011	12/8/2011
(Reporting units are in mg/kg)					
Acetone	1600	48	0.0084 J	0.011 U	25.7 J
Benzene	100	0.052	0.0011 U	0.0011 U	0.0462 J
Ethylbenzene	100	15.6	0.00037 J	0.0011 U	488
Toluene	100	13.8	0.0011 U	0.0011 U	1.84
Xylene (total)	300	196	0.00064 J	0.0011 U	1750
MIBK	330	4.6	0.0055 U	0.0054 U	850
Isopropyl Alcohol	NA	NA	0.12 U	0.12 U	7.39
Methanol	7.5 mg/l (TCLP)	32	0.252	0.257	2.68

Concentrations above Tier 2 screening levels are shaded

NOTES:

¹Tier 1 Levels represent alternative land disposal restriction treatment standards for contaminated media (i.e., ten times the universal treatment standard) in accordance with 40 CFR §268.49(c)(1)(C).

²Tier 2 Levels represent migration to groundwater screening levels from USEPA Regional Screening Levels (November, 2011). Values shown are based on a dilution attenuation factor of 20.

NA: Screening level not developed for this COC

Table 5
Estimated Extent and Volume of Impacted Soil By Cell
Building 5 Area Supplemental Soil Investigation
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Cell	Estimated Thickness of Impacted Soil (feet)	Estimated Thickness of Potentially Impacted Soil (feet)	Estimated Volume of Impacted Soil (cubic yards)	Estimated Volume of Potentially Impacted Soil (cubic yards)
Transect A				
I-1	7.5	0	56	0
I-2	10.5	4	78	30
I-3	7.5	5	56	38
I-4	10	0	75	0
I-5	0	0	0	0
I-6	0	0	0	0
P-1	0	0	0	0
Transect B				
I-7/I-7A	6	3	125	63
I-8	4	2	83	42
I-9	0	0	0	0
I-10	0	0	0	0
I-11	0	0	0	0
P-2	0	0	0	0
D-26/A-1R3	4	3.5	83	73
D-29	9	0	187	0
Transect C				
I-12	4.5	2	94	42
I-13	0	0	0	0
I-14	0	0	0	0
I-15	0	0	0	0
P-3	0	0	0	0
P-9/D-34	4.5	2	94	42
D-31	1	4	21	83
D-32	3.5	1.5	73	32
D-33	0	0	0	0
D-35	0	0	0	0
Transect D				
I-16	2.5	0	52	0
I-17	7.5	0	156	0
I-18	0	0	0	0
I-19	0	0	0	0
P-4	0	0	0	0
P-5	0	0	0	0
P-8	0	0	0	0
D-36	1	0	21	0
D-37	0	0	0	0
Total			1254	445

Table 6
Soil Vapor Sample Results
Building 5 Area Supplemental Soil Investigation
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Sample ID	I-7A		A-1R3A	
Sample Depth	(9.25-11 FT)		(9.25-11 FT)	
Sample Date	2/2/2012		2/2/2012	
Units	(mg/m³)	(ppmv)	(mg/m³)	(ppmv)
Benzene	0.997	0.312	<1.5	<0.48
Ethylbenzene	1950	448	1360	312
Toluene	1740	463	122	32.5
Xylenes (total)	4740	1090	4010	922
Acetone	120	50.4	266	112
MIBK	3340	815	1740	424
Isopropyl Alcohol	285	116	143	58.1
Methane	1540	2350	785	1200